

WHAT IS CLAIMED IS:

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1. A matrix substrate having plural switching elements provided in matrix corresponding to intersecting points of scanning lines and signal lines, plural picture element electrodes connected to the switching elements, and horizontal circuits and vertical circuits for inputting the signals to the switching elements, wherein the matrix substrate comprises a horizontal scanning circuit for sampling a picture data based on digital picture signals, a latch circuit for memorizing the data synchronously with output from the horizontal scanning circuit, a D/A converter for converting the output from the latch circuit into analog signals, plural signal transfer switches provided between the D/A converter and the signal lines, and a selection circuit for selecting at least one of the signal transfer switches.

2. The matrix substrate according to claim 1, wherein the analog signals are applied to the signal lines through the transfer switches in every output of the selection circuit.

3. The matrix substrate according to claim 1, wherein the number M of the D/A converters is less than the number N of said switching elements which is arranged in a horizontal direction, and analog signals

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are sequentially inputted from one converter to the plural switching elements the number of which is N/M arranged in a horizontal direction.

5 4. The matrix substrate according to claim 1, wherein the selection circuit is constituted of a shift register.

Sub 12 10a 5. The matrix substrate according to claim 1, wherein the switching element is ~~constituted of~~ a CMOS transistor.

15 6. The matrix substrate according to claim 1, wherein the matrix substrate comprises a means for inputting signal-polarity inverting signals together with the picture data, and inverting the polarity of the analog output of the D/A converter.

20 7. The matrix substrate according to claim 1, wherein the D/A converter is capable of inputting one bit more than the bit number of the picture data bits, and the signal-polarity inverting signal is inputted to the most significant bit of the D/A converter.

25 8. The matrix substrate according to claim 1, wherein the matrix substrate comprises a changeover switch for selecting one of at least two groups of the

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signal transfer switches to be inputted from the D/A converter.

5 9. The matrix substrate according to claim 8,
wherein the picture data is supplied in divisions, and
sampling is conducted by the horizontal scanning
circuit.

10 10. The matrix substrate according to claim 9,
wherein the matrix substrate comprises a means for
changeover of the divided picture data.

15 11. The matrix substrate according to claim 1,
wherein the matrix substrate has an elevation circuit
for boosting the output of the D/A booster.

20 12. The matrix substrate according to claim
11, wherein the booster circuit comprises a clamp type
amplifier.

25 13. The matrix substrate according to claim 1,
wherein the D/A converter provides analog signals by
selecting one point of a resistance element connected
in series by decoding digital signals of more
significant bit and less significant bit.

14. The matrix substrate according to claim

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13, wherein said resistance element for a resistance
division is comprised of a diffusion layer in a
semiconductor substrate, and an impurity concentration
of a diffusion layer comprising the resistance element
5 for the more significant bit is higher than that
comprising the resistance element for the less
significant bit.

15. The matrix substrate according to claim 1,
10 wherein the D/A converter comprises at least two analog
buffer circuits and a circuit for selecting one of the
two buffer circuits.

16. The matrix substrate according to claim
15 15, wherein the two buffer circuits are employed
respectively for positive polarity and for negative
polarity.

17. The matrix substrate according to claim 1,
20 wherein the picture element electrode is polished by
chemical mechanical polishing.

18. A liquid crystal device comprising a
matrix substrate having plural switching elements
provided in matrix corresponding to intersecting points
of scanning lines and signal lines, plural picture
element electrodes connected to the switching elements,

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and horizontal circuits and vertical circuits for
inputting the signals to the switching elements; a
counter substrate opposing to the matrix substrate; and
a liquid crystal material placed between the matrix
substrate and the counter substrate, wherein the matrix
substrate comprises a horizontal scanning circuit for
sampling a picture data based on digital picture
signals, a latch circuit for memorizing the data
synchronously with output from the horizontal scanning
circuit, a D/A converter for converting the output from
the latch circuit into analog signals, plural signal
transfer switches connected to output of the D/A
converter, and a selection circuit for selecting at
least one of the signal transfer switches.

19. The liquid crystal device according to
claim 18, wherein the analog signals are applied to the
signal lines through the transfer switches in every
output of the selection circuit.

20. The liquid crystal device according to
claim 18, wherein the number M of the D/A converters is
less than the number N of said switching elements which
is arranged in a horizontal direction, and analog
signals are sequentially inputted from one converter to
the switching elements the number of which is N/M
arranged in a horizontal direction.

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21. The liquid crystal device according to claim 18, wherein the selection circuit is constituted of a shift register.

5 22. The liquid crystal device according to
a claim 18, wherein the switching element is ~~constituted~~
a of a CMOS transistor.

10 23. The liquid crystal device according to
claim 18, wherein the matrix substrate comprises a
means for inputting signal-polarity inverting signals
together with the picture data, and inverting the
polarity of the analog output of the D/A converter.

15 24. The liquid crystal device according to
claim 18, wherein the D/A converter is capable of
inputting one bit more than the bit number of the
picture data bits, and the signal-polarity inverting
signal is inputted to the most significant bit of the
20 D/A converter.

25 25. The liquid crystal device according to
claim 18, wherein the matrix substrate comprises a
changeover switch for selecting one of at least two
groups of the signal transfer switches to be inputted
from the D/A converter.

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26. The liquid crystal device according to claim 25, wherein the picture data is supplied in divisions, and sampling is conducted by the horizontal scanning circuit.

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27. The liquid crystal device according to claim 26, wherein the matrix substrate comprises a means for changeover of the divided picture data.

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28. The liquid crystal device according to claim 18, wherein the matrix substrate has an booster circuit for boosting the output of the D/A converter.

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29. The liquid crystal device according to claim 28, wherein the booster circuit comprises a clamp type amplifier.

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30. The liquid crystal device according to claim 18, wherein the D/A converter provides analog signals by selecting one point of a resistance element connected in series by decoding digital signals of more significant bit and less significant bit.

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31. The liquid crystal device according to claim 30, wherein said resistance element for a resistance division is comprised of a diffusion layer in a semiconductor substrate, and an impurity

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concentration of the diffusion layer comprising the resistance element for the more significant bit is higher than that comprising the resistance element for the less significant bit.

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32. The liquid crystal device according to claim 18, wherein the D/A converter comprises at least two analog buffer circuits and a circuit for selecting one of the two buffer circuits.

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33. The liquid crystal device according to claim 32, wherein the two buffer circuits are employed respectively for positive polarity and for negative polarity.

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34. The liquid crystal device according to claim 18, wherein the picture element electrode is polished by chemical mechanical polishing.

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35. A display apparatus, comprising a liquid crystal device set forth in claim 18.

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36. The display apparatus according to claim 35, wherein the display apparatus comprises a reflection type liquid crystal panel as the liquid crystal device, and displays a picture image by introducing light emitted from a light source to the

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liquid crystal panel, and projecting reflected light through an optical system onto a screen.

37. The display apparatus according to claim
5 36, wherein the display apparatus employs a liquid
crystal panel comprising a picture element unit array
and a microlens array: the picture unit array having
picture element units arranged two-dimensionally at a
prescribed pitch on a substrate, the picture element
10 unit having three color picture elements, and a
combination of a first and second color picture
elements being arranged in a first direction and
another combination of the first and a third color
picture elements being arranged in a second direction
15 with the first color element common to the both
combinations; and the microlens array being arranged
two-dimensionally above the picture element unit array
at the pitch corresponding to the pitches of two color
picture element combinations arranged in the first and
20 second direction on the substrate.

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